Okuyama et al., Yamamoto and Ross, and claims 1, 3 and 9 stand rejected under §103 on the basis of Tani et al., Chang et al., Yamamoto and Ross.

Claim 1 has been amended to better define the invention over the cited references, and applicants' respectfully traverse for the following reasons.

As disclosed in the specification, an object of the present invention is to enable use of a hard substrate such as glass or silicon, because a hard substrate increases the shock resistance of a magnetic disk, while having excellent reproducing properties comparable to those of conventional magnetic disks having a NiP-plated aluminum substrate. The present inventors have found that such an object can be attained if the magnetic disk has the combination of features as recited in amended claim 1. More specifically:

(1) The glass or silicon substrate increases the shock resistance and thus the durability of the disk.

(2) The first Cr-based underlayer improves sputtering of a second NiP underlayer to the substrate.

(3) The sputtered NiP underlayer enables exact reproduction of the topographic features of the underlying substrate.

(4) Mechanical texturing of the NiP underlayer improves the anisotropy of the magnetic layer, along with prevention of head stiction.

(5) The controlled P content of the 15 to 35 at % is especially suitable for texturing of the NiP underlayer.

(6) The controlled surface roughness of less than 2 nm is especially suitable for floating a magnetic head over the disk.

(7) The third Cr-based underlayer of at most 60 nm ensures the increased texturing effects of the NiP underlayer.

(8) The widened lattice spacing of the third underlayer accelerates a preferential longitudinal orientation for the C-axis of the magnetic layer.

(9) The Cr content of at least 14 at % and the Pt content of at least 4 at % enable a magnetic layer having a high S/N ratio to be obtained.

In summary, according to the present invention, prevention of peeling of the NiP underlayer, good anisotropy, low noise, high S/N ratio and good floatability of the head can be simultaneously obtained in a magnetic disk using glass or silicon as a substrate, results not found in the prior art cited by the Examiner.

Tani et al. teach the use of a glass substrate. However, they do not describe a way to improve the adhesion of the NiP underlayer to the substrate, while the present invention teaches use of a first Cr-based layer.

Further, although they teach texturing of the NiP underlayer, Tani et al. are silent concerning anisotropy at a substantially flat surface of the magnetic layer, and a surface roughness of less than 2 nm, which are important features of the present invention.

Furthermore, Tani et al. are silent concerning the third Cr-based underlayer, which is important for the present invention in controlling lattice matching with a Pt-

containing magnetic layer.

Okuyama et al. teach only use of a four- or five- component metal alloy in the formation of a magnetic layer. Okuyama et al. are silent concerning an important relation between a first Cr-based layer and a second sputtered NiP layer, because they are not directed to use of a hard glass substrate.

Yamamoto teaches texturing. However, this reference is clearly distinguishable from the present invention, because an aluminum disk is used as a substrate, and a NiP coat layer is obtained by electrolytic or nonelectrolytic metal plating. According to the present invention, since sputtering is used in the formation of the NiP layer, strong bonding of the NiP layer through the Cr-based underlayer to the glass or silicon substrate can be obtained. This NiP-plated aluminum disk does not provide any motivation for completing the present invention, because the use of glass in place of aluminum in the NiP-plated aluminum substrate does not create magnetic anisotropy in the circumferential direction, and the NiP-plated aluminum substrate does not ensure high impact resistance.

Ross teaches the use of a glass substrate in combination with the NiP underlayer. However, assuming that an adhesion layer 12 corresponds to the first Cr-based underlayer of the present invention, a textured film 14 cannot act as the second underlayer of the present invention. It should be noted that a NiP underlayer 16 is positioned apart from the adhesion film 12. Further, in Ross, the third underlayer of the present invention is missing, because a magnetic layer 17 is directly laminated to the NiP underlayer 16.

Further, as is disclosed in column 4, lines 48 to 57 of Ross, a glass substrate 11 has a smooth surface because no irregularities are required due to the presence of an adhesion layer 12. Contrary to this, according to the present invention, non-oriented irregularities are applied to a surface of the glass substrate.

Furthermore, Ross is silent concerning other essential features of the present invention which were newly introduced amended claim 1.

Chang et al. describe surface roughness of the seed (NiP) layer on a glass substrate. However, such surface roughness is produced upon oxidation, as is disclosed in column 6, lines 28 to 46 of Chang et al., whereas according to the present invention, the textured structure is formed upon mechanical treatment.

Further, Chang et al. are silent concerning application of a first Cr-based underlayer between a glass substrate and a second NiP underlayer in order to improve their bonding strength.

As will be appreciated from the above discussion, each reference teaches one or more features of the present invention. However, they do not provide sufficient motivation to combine such features under the specific and complex conditions of the present invention, so as to provide a magnetic disk having unexpectedly excellent properties comparable to those of a NiP-plated aluminum substrate.

For the foregoing reasons, applicants believe that this case is in condition for allowance, which is respectfully requested. The Examiner should call applicants' attorney to expedite prosecution.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

The paragraph beginning on page 18, line 24, has been amended as follows:

In the NiP underlayer, a ratio (at%) of nickel (Ni) and phosphorus (P) constituting the underlayer may be varied depending upon the desired effects and other factors, however, it is particularly preferred that a ratio of Ni and P (Ni:P) be in the range of about [67 to 85:35 to 15] <u>(67 to 85): (33 to 15)</u>. In other words, a content (concentration) of P in the NiP underlayer is preferably about 15 to 33 at%. The lower limit of the P concentration in the Ni<u>P</u> underlayer is 15 at% at which the NiP underlayer can substantially show a non-magnetic property, since the NiP underlayer should have a non-magnetic property to avoid any problems in the magnetic recording. The NiP alloy may have different forms, and when the NiP alloy in the form of a crystalline body is considered, the NiP alloy with the highest P concentration is Ni_3P which is known to be a non-magnetic material. Further, it is also known that NiP can be in the form of an amorphous structure, if the P concentration is in the range of 15 to 26 at%. Note, in this connection, that the NiP layer in an amorphous form has substantially a non-magnetic property, but, if the P concentration is reduced to below 15 at%, a magnetic property is

produced in the NiP layer as a result of deposition of a Ni layer. The upper limit of the P concentration in the NiP underlayer is 33 at%, because if the P concentration is increased to above 33 at%, there is no target NiP sufficient to satisfy the sputtering process. That is, the NiP target material containing an increased amount of P is brittle and therefore it cannot be fabricated to a hard NiP target having a high purity.

In the Claims:

Claim 1 has been amended as follows:

1. (Twice Amended) A magnetic recording disk comprising a nonmagnetic glass or silicon substrate having non-oriented irregularities on a surface thereof, and, having applied thereon in the following order:

an underlayer which comprises a first underlayer containing chromium as a principal component thereof, a second [and] sputtered underlayer consisting of nickel and phosphorus and a third underlayer containing chromium as a principal component thereof which are formed in the described order,

said second underlayer has a thickness of not less than 5nm, contains P in the concentration of 15 to 33 atom % in the NiP layer and has a textured structure having a surface roughness Ra_2 in a radial direction of less than 2 nm formed [upon] by mechanical treatment, [and] wherein

said third underlayer has a thickness of not more than 60 nm and has a widened lattice spacing approaching the lattice spacing of a magnetic recording layer

formed thereon, and

a magnetic recording layer which has a circumferential direction of easy magnetization and contains cobalt as a principal component thereof, and also contains chromium in an amount of at least 14 at % and platinum in an amount of at least 4 at % in combination with tantalum or tantalum and niobium.